NAVSHIPS 0967-061-2000

Technical Manual

PANADAPTOR

MODEL SA-3

TYPES

T-50, T-100, T-200, T-1000

(SINGER COMPANY)

CONTRACT NO. NObs4817

GENERAL DYNAMICS
Electronics Division

DECEMBER 1966

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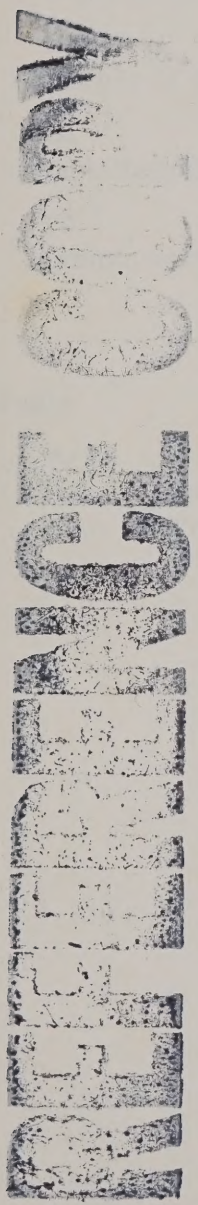

PANORAMIC PANADAPTOR

MODEL SA-3

TYPES T-50, T-100, T-200, T-1000

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ADDENDA

Addenda are incorporated in this Instruction Manual for the following reasons:

1. To describe circuit improvements made upon the subject equipment since the publication of the manual.

2. To correct errors in the manual.

3. To describe any differences between the basic model(s) covered by this manual and special variations of these model(s).

4. To discuss maintenance problems that have arisen.

5. To provide information for expanding the usefulness and versatility of the equipment.

ADDENDUM

for

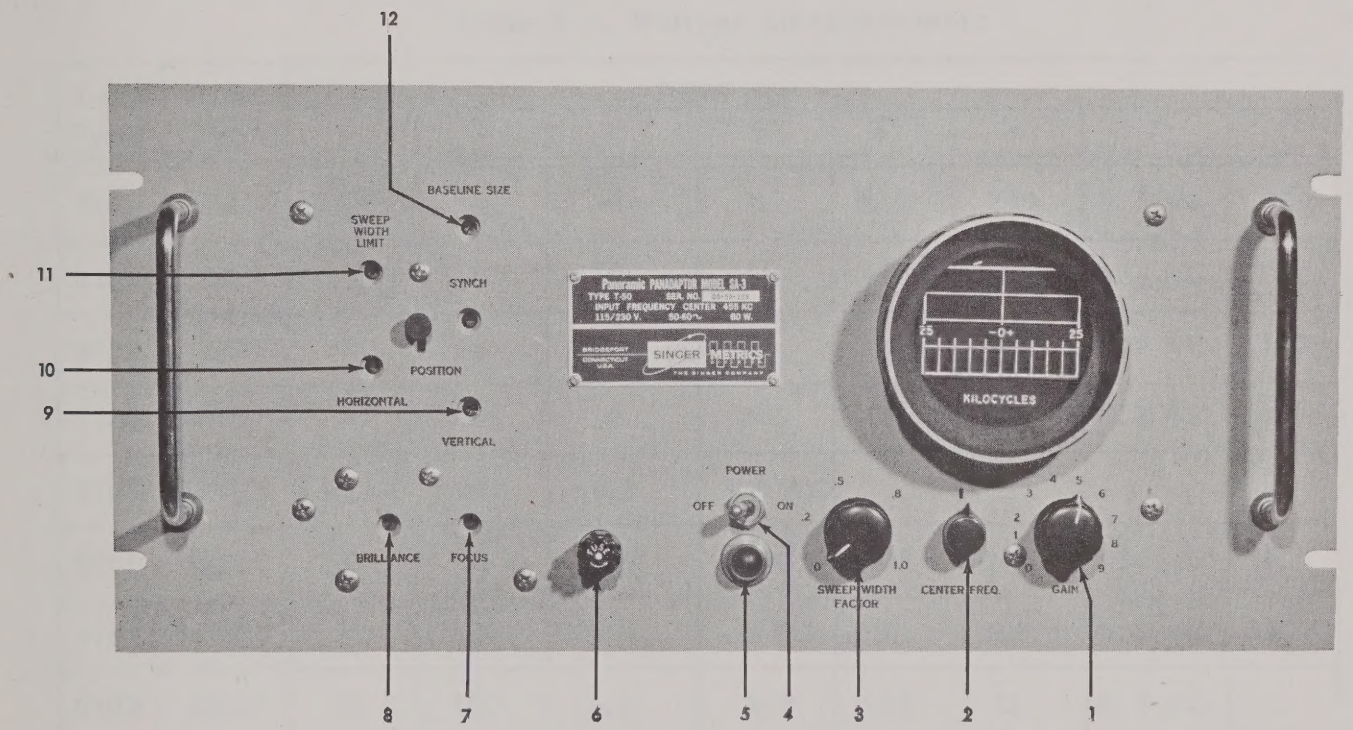
MODEL SA-3

A. PURPOSE. To add supplementary data to the Instruction Manual for Model SA-3.

B. SUPPLEMENTARY DATA.

1. FRONT PANEL CONTROLS.

The front panel controls are illustrated in figure A-1 and described in Section 1., paragraph 2. of the Instruction Manual.



1 - GAIN
2 - CENTER FREQ.
3 - SWEEP WIDTH FACTOR
4 - POWER OFF-ON
5 - PILOT LIGHT
6 - FUSE
7 - FOCUS
8 - BRILLIANCE
9 - VERTICAL
10 - HORIZONTAL
11 - SWEEP WIDTH LIMIT
12 - BASELINE SIZE

Figure A-1. Front Panel Controls, Model SA-3, Type T-50

2. VOLTAGE AND RESISTANCE MEASUREMENTS.

The voltage and resistance measurements listed in Tables A-1 and A-2, respectively, were taken with an R.C.A. Senior Voltohmyst, Model WV-98B. The controls on the Model SA-3 were set as follows:

GAIN - Fully clockwise SWEEP WIDTH FACTOR - 1.0
CENTER FREQ. - center All others - normal operation

NOTES:

a. Unless otherwise indicated:
   1) All readings are to ground
   2) All voltages are DC
   3) All resistances are in ohms.

b. K = Kilohms; M = Megohms; N.C. = No Connection; L.O. = Less than 1 ohm

Table A-1. Voltage Measurements

Tube Sym.	Tube Type	PINS							
		1	2	3	4	5	6	7	8
V101	6AC7	0	0	0	0	4.5	190	6.3 AC	100
V102	6SA7	0	0	300	105	-9	1.7 AC	6.3 AC	-1
V103	6SG7	0	0	2.6	0	2.6	23	6.3 AC	300
V104	6SG7	0	-.5	0	NC	-.5	135	6.3 AC	0
V105	2X2	820 AC	1040	1010	820 AC				
V106	0C3	0	0	320	NC	105	NC	320	NC
V107	6AC7	0	0	0	.8 AC	3	105	6.3 AC	300
V108	6SL7	5	180	6.6	8.8	185	11	6.3 AC	0
V109	3BP1A	-1060	-1000	-1010	NC	-640	NC	180	185
		9	10	11	12	13	14	PINS	
		210	180	135	NC	NC	-1060		
V110	6X5	0	0	280 AC	NC	280 AC	NC	6.3 AC	350
V111	6SL7	8.2	180	12.5	.37	80	0	6.3 AC	0

Table A-2. Resistance Measurements

Tube Sym	Tube Type	PINS							
		1	2	3	4	5	6	7	8
V101	6AC7	0	0	0	6	560	26 K	LO	28 K
V102	6SA7	0	0	25 K	26 K	20 K	LO	LO	1 K
V103	6SG7	0	0	1 K	40	1 K	12 K	LO	26 K
V104	6SG7	0	510 K	0	NC	510 K	1.6 K	LO	0
V105	2X2	1.1 K	1 M	950 K	1.1 K				
V106	0C3	0	0	22 K	NC	26 K	NC	22 K	NC
V107	6AC7	0	0	0	450 K	1.4 K	26 K	LO	3 K
V108	6SL7	75 K	180 K	3 K	100 K	260 K	5.6 K	LO	0
V109	3BP1A	900 K	900 K	925 K	NC	580 K	NC	230 K	260 K
		9	10	11	12	13	14	PINS	
		75 K	180 K	1.6K	NC	M	900K		
V110	6X5	0	0	150	NC	150	NC	LO	23 K
V111	6SL7	850 K	230 K	26 K	1 Meg	2.8 Meg	0	LO	0

3. TROUBLE ANALYSIS PROCEDURE.

Table A-3 is a Trouble Analysis chart to be used as a guide in trouble shooting this equipment. The principal types of troubles that may be encountered are considered. For each trouble, the likely causes are indicated. When a tube is listed as a likely cause, this implies an investigation of the tube and its associated circuitry.

Table A-3. Trouble Analysis Chart

SYMPTOM	PROCEDURE
Pilot lamp does not light	Check 2 amp Fuse (F101). Replace pilot lamp. Check power connections.
2 amp Fuse (F101) blows when replaced.	Check for B+ short. Check T104 and its load. Check for A.C. filament short.
No C.R.T. illumination	Check adjustment of FOCUS and BRILLIANCE controls. Check high voltage. If H.V. is incorrect, check V105. Check C.R.T. V109.
Dot on C.R.T.	Check B+. If B+ is incorrect, check V106 and V110. Check V111. Check adjustment of BASELINE SIZE.
Horizontal and/or vertical position incorrect	Check control adjustments. Check V108, V104, V111.
Baseline, but no pip appears when signal is applied	Check position of GAIN control. Check V101, V102, V103, V104, V107.
Baseline rises when signal is applied	Check sweep width. Check control positions of SWEEP WIDTH LIMIT and SWEEP WIDTH FACTOR. Check V107.
Baseline size incorrect	Check adjustment of BASELINE SIZE. Check V111 and V108.
Baseline jittery or moves.	Check adjustment of SYNCH control. Check V111.

ADDENDUM

The Panadapter used in the Apollo Range Instrumentation Ship Communications System (CS3A1A1) is the Model SA-3 type T-50, aligned to a center frequency of 500 kc. Disregard all references to Models T-100, T-200 and T-1000 in the instruction manual. The different frequency necessitates the following detail changes to the instruction manual:

Page 8: For model T-50, change input center frequency range from 450-470 KC to 490-510 KC

Page 26: Under 1., change Input Center Frequency for Type T 50 from 455 KC to 500 KC. In paragraph (b0 1., change type T-50 High Frequency Alignment from 480 KC to 525 KC and Low Frequency Alignment from 430 KC to 475 KC.

Page 28: Change type T-50 RF alignment frequencies as follows:

a) Input Center Frequency from 455 KC to 500 KC.
b) High peaking Frequency from 478 KC to 523 KC.
c) Low peaking Frequency from 432 KC to 477 KC.

Pages 38 and 40: Change Parts List as follows:

T101	Transformer, R. F. 500 KC ±25 KC	556026-165
T102	Transformer, R. F. 500 KC ± 25 KC	556026-166
Z101	Coil, oscillator, 610 KC ±25 KC	556026-167

Circuit Diagram: Change frequency of T101 and T102 from 455 KC ± 25 KC to 500 KC ± 25 KC and change frequency of Z101 from 565 KC ± 25 KC to 600 KC ± 25 KC.

GD/E Addendum No. 1

SECTION 1. GENERAL DESCRIPTION

1.01 Introduction

Upon connecting the PANADAPTOR to a superheterodyne type receiver, the operator will be enabled to see on the panoramic screen all stations receivable within a band of the station to which he is listening. The scanning width or extent of the band above or below the frequency to which the receiver is tuned is designated in the type number of the Panadaptor as follows:

TYPE	SCANNING WIDTH
T-50	± 25 KC
T-100	± 50 KC
T-200	± 100 KC
T-1000	± 500 KC

The receiver will operate normally and the operator will not only hear the station to which it is tuned, but will also see it and signals of adjacent frequency.

The PANADAPTOR is a device which allows the operator to visualize the radio spectrum on a two-dimensional surface: On the horizontal axis of the screen (base line) frequencies are shown, and on the vertical axis the signal amplitudes are shown. This is illustrated in Fig. 1.

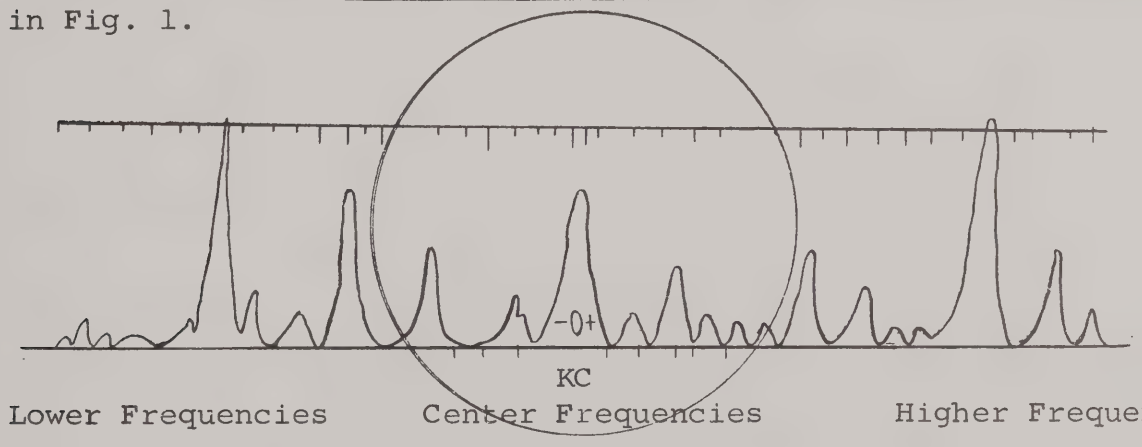


Figure 1

RADIO FREQUENCIES SPECTRUM

The entire strip represents the portion of the radio-frequency spectrum covered by the tuning range of your receiver. The circle in the center represents the range visable on the screen of the panoramic adaptor. The section directly over the Zero (0) on the scale represents the signals to which the receiver is tuned. The peaks represent signals or stations. Every signal has its own separate peak or deflection, which tells its own story.

First: It tells the frequency of the signal with respect to the station to which the receiver is tuned, and which is read on the receiver dial.

The screen has a calibrated scale, marked Zero in the center, plus (+) to the right, and minus (-) to the left. Zero represents the receiver dial indication, and each division equals one-tenth of the total scanning width.

Taking the frequency reading of the station to which you are listening from the receiver dial, add or subtract the calibration on the screen scale corresponding to the signal peak under observation, and you have the frequency of the signal.

Second: It also tells roughly the strength of the signals that are shown on the screen. The height of each signal peak varies with the strength of the signal, strong signals having high peaks and weak signals having small peaks. With a little experience the operator will be able to judge comparative signal strengths.

Third: It reveals the character of the signal and the type of modulation, whether amplitude or frequency modulation, whether CW, or phone, or pulse, etc.

1.02 Dimensions and weight:

Overall Size:	Width	13-1/2	inches
	Height	8-3/4	"
	Depth	15	"
Panel Size:	Width	13-1/4	"
	Height	7-3/8	"
	Depth of Cabinet	13	"
	Cathode Ray Shield Projection from Front Panel.....	1-7/8	"
	Distance between bottom of shock mounts and cabinet	1-3/8	"
	Weight of Chassis with tubes	32	pounds
	Total weight of adaptor	43	pounds

1.03 Tube Compliment:

The tubes employed are as follows:

Symbol (Drawing)	Type Designation	Function
V101	6AC7	1st R.F. Amplifier
V102	6SA7	Converter

Symbol (drawing)	Type Destination	Function
V103	6SG7	1st I.F. Amplifier
V104	6SQ7	2nd Det. and 1/2 of push/pull Vert. Amp.
V105	2x2	C.R.T. Power Supply Rectifier
V106	OC3/VR105	Voltage Regulator for R.F. Amplifier Plate, for Rectifier Screen, and for Oscillator Plate.
V107	6AC7	Reactance Modulator
V108	6SL7-GT	1/2 of push-pull vert. Amplifier
V109	3BP1	Cathode Ray Indicator
V110	6X5(GT/G)	Low Voltage Power Supply
V111	6SL7-GT	Blocking Tube. Osc. and 1/2 of push-pull Horizontal Amplifier.

2. Detailed Description of the Chassis

2.01 Front Panel

The power switch is located in the center of the panel and must be turned on. in addition to the receiver's power switch, when operation is desired.

The pilot light is directly underneath. It goes on and off with the power switch.

The fuse, located just to the left of the switch and pilot light, is easily replaceable.

The screen is at the upper right. It is the end of the cathode ray tube which is mounted in the panel in a rubber "boot".

The screen shield. The end of the tube is protected by a green plastic screen shield. This plastic shield protects the tube from damage, and protects the operator from shattered glass. The screen shield is marked with a zero (0) in the center of the horizontal line. * On the right of zero is a plus sign, indicating higher frequency than at the center. On the left

---

* Note: When the adaptor is tested alone (i.e., without a receiver) and the signals from a signal generator are fed directly into its input, the operator should remember that the above signs must be reversed.

of zero is a minus (-) sign indicating lower frequency than at the center. This is true provided the oscillator of the companion receiver is of higher frequency than its R.F. input. The signs are to be reversed if the oscillator is of lower frequency.

The screen is calibrated with five equal spaces, right and left of the center. Each line represents one-tenth of the full sweep or scanning width.

2.02 Main Operating Controls

SWEEPWIDTH FACTOR. This is the sweepwidth control. When this control is turned all the way to the right, (clockwise) the maximum band for which the adaptor is designed can be seen on the screen. As this control is turned to the left, the band is made narrower, but the part that can be seen is magnified or spread out.

This control is very useful when two or more signals are so close as almost to merge into each other. Then when the sweep is reduced they will seem to separate, and the operator can tune the receiver more accurately.

Center Freq. (Center Frequency Control) It is desirable to match the adaptor accurately to the receiver. By this it is meant that the signals which are heard in the receiver should come exactly in the center of the base line at its zero mark. Once proper initial alignment has been established, this control is used to maintain or restore the matched condition. The method will be detailed below.

GAIN. This governs the Panadaptor sensitivity.

2.03 Semi-adjustable Controls. On the left of the panel, there are seven holes under each of which is a control which can be adjusted by using a screwdriver. Ordinarily these controls are never used, but sometimes they are necessary to adjust or service the equipment. The name of each control is plainly marked on the panel.

Four are marked in white.

Three are marked in red.

CAUTION is required in adjusting the controls. Until the operator thoroughly understands how the set performs the adaptor will perform improperly if the controls are moved.

The four white (seldom used) controls are:

1. Vertical Position: This adjusts the vertical position of the base line on the screen, which should be very close to the calibration line of the screen scale.

2. Brilliance: This controls the intensity or brightness of the line on the screen.

3. Focus: This controls the sharpness of the line on the screen.

4. Horizontal Position: This control governs the position of the base line, and is used to bring the signal you hear on the receiver exactly in line with the zero (0) on the scale at full sweep. This control used in conjunction with CENTER FREQ(uency) does not have to be used much, but it does permit rapid correction of slight center frequency drift while the receiver or adaptor are cold. Final adjustment of HOR. POSITION should be made after the adjustment of CENTER FREQ. See Par. 8.05.

There will be little need for adjusting any of these white marked controls.

The three RED Controls are:

1. SWEEPWIDTH LIMIT: This control limits the width of the band which is covered.

2. BASELINE SIZE: This controls the length of the base line on the screen, which should be slightly longer than the calibrated scale.

3. SYNCH: This controls the speed with which the "spot" sweeps across the screen in synchronism with the A.C. power source. Normally, it is set for 30 sweep cycles per second when operating from a 60 cycle sources of power, and for 25 sweep cycles when operating from 50 cycles.

3. Terms and Definitions

3.01 Panoramic Reception is the simultaneous visual reception of several radio signaling stations whose frequencies are distributed over a continuous portion of the frequency spectrum. This definition distinguishes panoramic reception from the conventional reception which can be called "uni-signal" reception

3.01 Cont.

and which can be either aural or visual, or both.

The main distinction between panoramic and uni-signal reception is the following: Panoramic reception is periodic reception over a wide range of the spectrum. Each signal is received at fixed, rapid intervals, for a short period of time. (These signals are received so rapidly as to appear to be continuous.) Uni-signal reception is continuous reception, of the one signal at a time, over a very narrow range of the spectrum.

3.02 Companion Receiver is the aural receiver with which the panoramic adaptor is operated.

3.03 Sweepwidth is the total band, measured in kilocycles, which can be observed by panoramic reception and which corresponds to the range of frequency sweep of the oscillator in the panoramic adaptor. Sweepwidth should not be confused with signal frequency, although both are measured in the same units (kilocycles).

3.04 Base Line is the horizontal line produced on the cathode-ray tube by the sawtooth generator and its associated amplifiers.

3.05 Center Frequency is the frequency of a signal which causes a vertical deflection of the base line when the sweepwidth control is set at zero. The center frequency of the panoramic adaptor must be made to correspond to the frequency of the intermediate amplifier of the companion receiver.

3.06 Screen Scale is the scale adjacent to the base line, which is calibrated in kilocycles above and below center frequency for a maximum sweepwidth setting.

3.07 Deflection Amplitude is the visual equivalent of signal output strength and is represented by the height of a given signal deflection measured from the base line to the tip of the deflection.

3.08 Resolution is the visual equivalent of selectivity and is represented by the frequency difference between two signals of equal amplitude which intersect 30% down from their peaks amplitude. It can be said that the resolution is "better" as this frequency difference decreases.

3.09 Sweep Frequency is the frequency of the voltage applied to the horizontal plates of the cathode-ray tube. This voltage has a sawtooth wave shape.

SECTION II - Theory of Operation

4.01 Companion Receiver - The companion receiver must be a superheterodyne receiver having an intermediate frequency equal to the input frequency of the Panadaptor.

In the output of the converter tube of a superheterodyne receiver there are signals whose frequencies extend on either side of the I.F. amplifier frequency.

This I.F. amplifier (being very selective) will pass only those signals to which it is tuned, enabling the operator to hear only one station, in the phones or loud speaker.

4.02 PANADAPTOR - The PANADAPTOR is a complete superheterodyne receiver in itself. The adaptor's input is connected to the output of the mixer tube of the companion receiver. This it will receive signals over a relatively wide band. Because of the radio frequency amplification of the receiver, the signals in the plate of the converter, other than those of its intermediate frequency, will be relatively weak.

The panoramic adaptor has an input amplifying stage with a band-pass characteristic which is inverse to that of the receiver. That is, it amplifies where the receiver attenuates, and vice-versa. When the two units are used together, the overall band-pass characteristic tends to be uniform, through the frequency spectrum. The degree of uniformity will vary as the receiver is tuned through different bands. This is due to the difference in receiver front end selectivity for various bands.

ELECTRICAL CHARACTERISTICS

P A N A D A P T O R

Model SA-3

Types	T-50	T-200	T-1000	T-1000	T-1000
Max. Sweepwidth	50 KC	200 KC	1 MC	1 MC	1 MC
Input Center Freq. Range	450-470 KC	450-470 KC			
Factory Aligned to	455 KC	455 KC	5.25 MC	10.2 MC	10.7 MC
Sensitivity for ¼" deflection	200 uV	200 uV	200 uV	200 uV	200 uV
Resolution: At Max. Sweepwidth	2.5 KC	4.4 KC	11.0 KC	11.0 KC	11.0 KC
Resolution: At 20% Max. Sweepwidth	1.9 KC	4 KC	9 KC	9 KC	9 KC
Bandpass Characteristic: Amplitude Ratio of Side Peaks to Center Valley	6.1	30.1	5.1	4.1	3.1
Coupled to Receiver through	5uuf CAP.	10uuf CAP.	10uuf CAP.	10uuf CAP.	10uuf CAP.
R.F. Input Cable	RG-11/U				
Power Source Req.	single phase, 115/230V, 50-60 cycles				
Power Consumption	55 watts				
Tube Size	3" C R T				

ELECTRICAL CHARACTERISTICS

P A N A D A P T O R

Model SA-3

Types	T-100	T-100
Max. Sweepwidth	100 KC	100 KC
Input Center Freq. Range	450-470 KC	495-505 KC
Factory Aligned to	455 KC	500 KC
Sensitivity for 1/4" deflection	200 uV	200 uV
Resclution: At Max. Sweepwidth	3.4 KC	3.4 KC
Resolution: At 20% Max. Sweepwidth	2.7 KC	2.7 KC
Bandpass Characteristic: Amplitude Ratio of Side Peaks to Center Valley	8:1	8:1
Coupled to Receiver through	5 uuf capacitor	5 uuf capacitor
R.F. Input Cable	RG-11/U	
Power Source Req.	single phase, 115/230 V, 50-60 cycles	
Power Consumption	55 watts	
Tube Size	3" C R T	

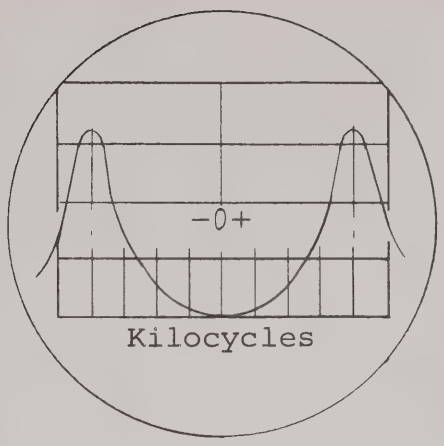


Fig. 7
BANDPASS CHARACTERISTICS

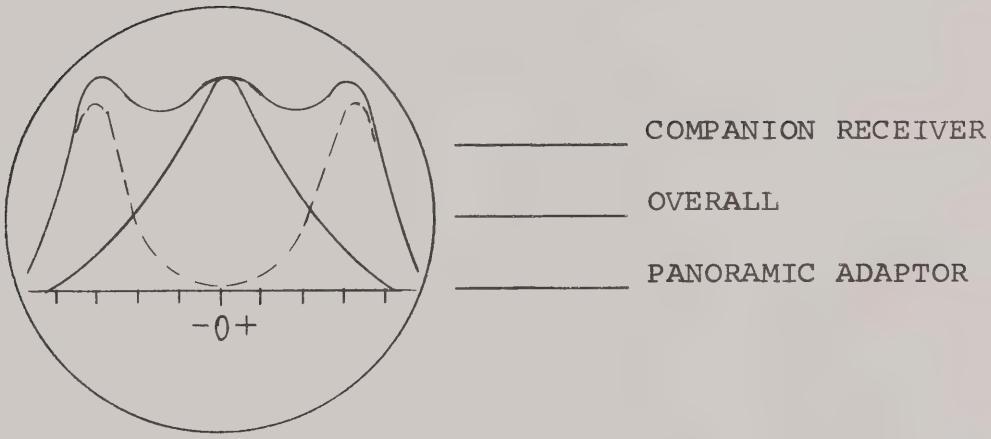


FIG. 8 - OVERALL BANDPASS CHARACTERISTICS

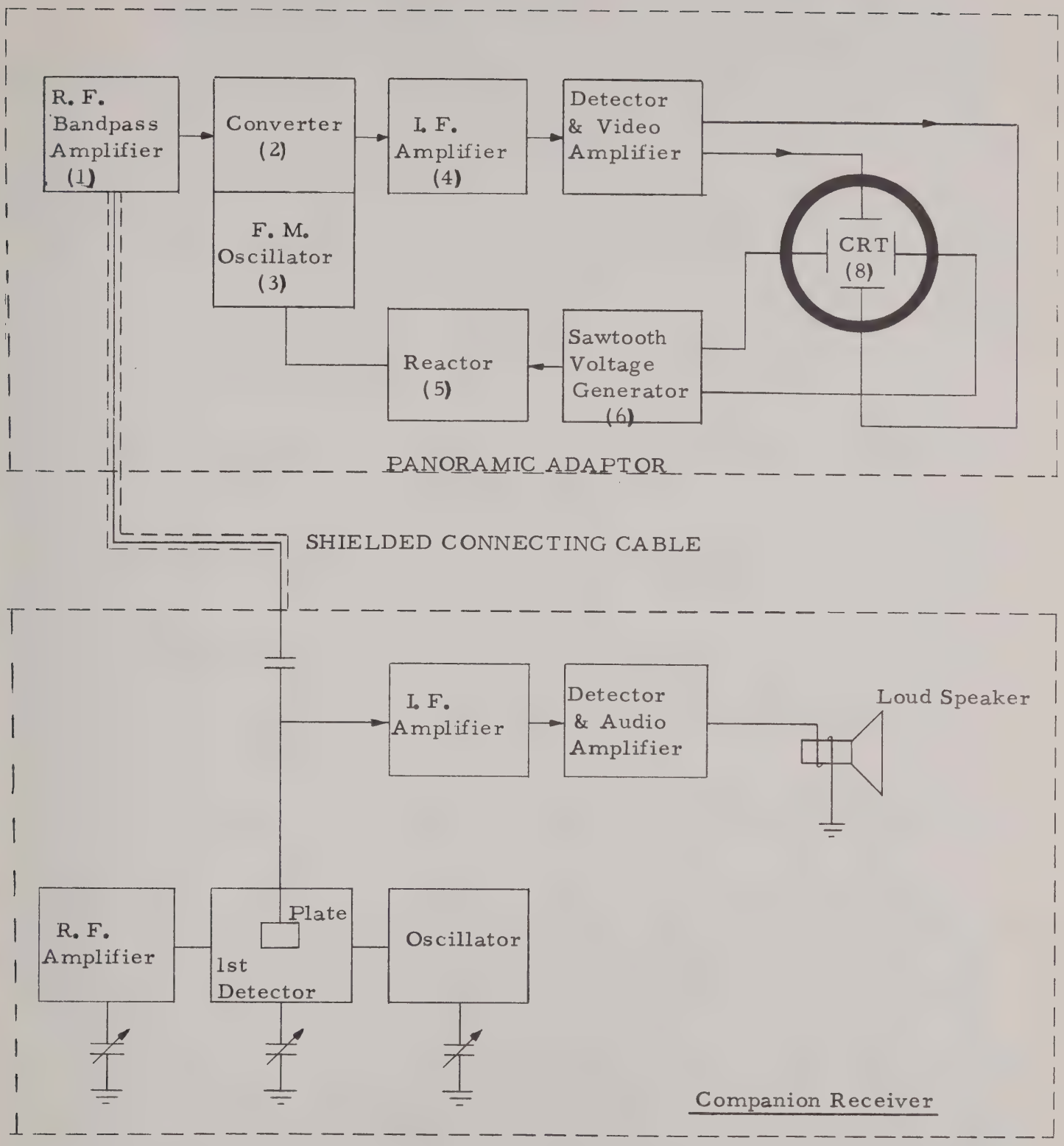


Fig. 9 - Block Diagram

4.03 BANDPASS AMPLIFYING STAGE. Refer to Block Diagram for a description of various steps by which panoramic reception is obtained. Block marked (1) is an R.F. bandpass amplifier (Fig. 7), which is the input stage of the panoramic adaptor, and is connected to the plate of the first detector of the receiver, through the isolating resistor or condensor. This isolating element prevents detuning of the receiver and permits the latter to operate normally.

As previously stated, the amplifying characteristics of this R.F. bandpass amplifier is such as to emphasize the bands away from the center frequency, thus amplifying the extremities of the bands more than the center. In this manner partial compensation for the selectivity of the R.F. or pre-selector stages of the companion receiver is obtained. This compensation will vary with the companion receiver's input frequency.

4.04 Mixer Stage: The signals from the R.F. bandpass amplifier are fed into the converter stage (2), where they are mixed with the signals from the oscillator (3).

4.05 Oscillator Stage: This oscillator (3) is frequency-modulated over a frequency F_o at a fixed, rapid rate, extending up to one half the sweepwidth above and below the mean frequency.

4.06 Reactor: The oscillator (3) is frequency-modulated as stated above. This action takes place entirely by electronic means. A reactance tube (5) forming part of the tuned circuit of the oscillator, varies the frequency of the oscillator in step with a sawtooth sweep voltage applied to its grid.

The mean frequency is adjusted to represent the sum of the receiver's I.F. and the adaptor's I.F. (It is the difference in 10.2 MC and 10.7 MC input T1000.)

The signals from the output of the converter are fed into a sharply tuned I.F. amplifier (4), and from there the signals are detected and amplified into a video amplifier (7). The signals from the output of this amplifier are fed into the vertical deflecting plates of the cathode-ray tubes (8).

4.07 Sweep Generator: The sweep voltage is supplied by a sawtooth voltage generator (6), thereby effecting a linear frequency expansion, or tuning, or the oscillator. The same sawtooth voltage is also applied to the horizontal deflecting plates of the cathode-ray tube. Thus the movement of the cathode-ray beam on the screen is synchronized with the tuning of the oscillator.

4.07 cont.

Each signal appears only periodically, and for only a fraction of the total time. All the signals will give the illusion of being on the screen simultaneously, due to the persistance of the cathode-ray screen, retentivity of vision, and rapidity of the horizontal sweep. This must be fully understood to facilitate the operator's interpretation of the signals seen.

More complete details as to the functioning of every circuit of the panoramic adaptor are given in Section IV (Maintenance).

SECTION 111 - INSTALLATION AND OPERATION

Connection of Panoramic Adaptor to Receiver

The PANADAPTOR is normally wired for a 115 volt, 50/60 cycles single phase, alternating current, power source. BE SURE TO HAVE THIS POWER AVAILABLE. The power connections can be set at the factory for 230 volt operation.

Find the proper place for the adaptor. If possible do not mount adaptor over ventilation holes of companion receiver.

(a) Make sure the RECEIVER has an intermediate frequency which corresponds to the input frequency of the adaptor.

(b) Disconnect the receiver from the power line.

(c) The co-axial cable supplied with the equipment has a male plug at one end. That end fits into the input female receptacle in the rear of the adaptor. The other end must be connected to the plate of the receiver's mixer tube (first detector) with the specified isolating element in series.

NOTE: IF THE COMPANION RECEIVER IS NOT PROVIDED WITH A RECEPTACLE FOR OPERATION WITH A PANADAPTOR, proceed as follows:

Drill a 3/4" hole through the receiver cabinet, somewhere near the plate prong of the mixer tube, and fit a rubber grommet into the hole.

Connect the isolating element as closely as possible to the plate prong of the receiver's mixer tube (first detector.)

Insert the free end of the co-axial cable through the hole with a grommet, and connect the inside conductor to the other end of the isolator. Connect the outside of the cable (shield) through a cable clamp to the receiver chassis, and make sure you have a good ground connection.

Now the other end of the co-axial cable, with the plug, may be inserted into the receptacle in the rear of the PANADAPTOR.

8. Operating Procedure

Now that the receiver and the adaptor are connected, they are ready to operate as follows:

8.01 Again plug in both receiver and adaptor power cords. Turn on the receiver - and check its operation.

NOTE: The antenna should remain connected to the receiver in the normal manner.

8.02 Turn on the adaptor and wait for the base line to appear.

8.03 Turn "GAIN" Control up about half way.

8.04 Slowly tune the receiver and soon there will be one or more, signals appearing on the panoramic screen, moving across it.

8.05 Tune in any station on the receiver, using phones or speaker. The signal should appear on the panoramic adaptor screen DIRECTLY over the zero (0), that is, exactly in the center of the scale. For best results, it is advisable to adjust the mean frequency of the Panoramic adaptor oscillator to give a signal which remains in the center of the screen no matter what the position of the "SWEEPWIDTH FACTOR" control. (This should be done after the adaptor has been allowed to warm up.)

The above adjustment is accomplished by turning the "SWEEP WIDTH FACTOR" control fully counterclockwise and then centering the deflection peak by rotating the "CENTER FREQ." knob. Turning the "SWEEP WIDTH FACTOR" fully clockwise should now leave the peak at the zero mark on the screen; if not, adjust HOR. POSITION Control. The CENTER FREQ. control should be adjusted only infrequently. Incorrect adjustment of the "CENTER FREQ." control will result in throwing the adaptor out of alignment with the companion receiver, as far as "CENTER FREQ." is concerned.

9. Interpretation of Signals

With a little experience, the operator will be able to recognize visually the character of the various types of signals, without the need of listening to them. It must be remembered, however, that the Panoramic radio adaptor can show only what the radio receiver is able to receive and no more. A poorly adjusted receiver cannot be expected to give good results even with perfectly adjusted adaptor.

9.01 A constant carrier appears as a deflection of fixed height.

9.02 An amplitude modulated carrier appears as a deflection of variable height. Voice or music modulation causes the carrier to vary irregularly. A constant tone modulation of low frequency will produce a series of convolutions varying in height, their number being determined by the modulation frequency.

As the modulation frequency increases the convolutions move toward the two sides of the deflection, as the side bands tend to become visible. When the modulation frequency is increased, it becomes possible to separate the two side bands by reducing the sweepwidth of the adaptor. The higher the frequency of modulation, the farther away these side bands will move from the center deflection, representing the carrier. One should remember that due to possible non-linear amplification of the receiver, or of the adaptor, or both, over a wide band, the two side bands may appear unequal in height, even though they are of equal strength. Their relative heights may vary as the receiver is tuned and as the deflection moves from one end of the screen to the other.

9.03 Single side-band modulation appears as two carriers of slightly different frequency (See below. "Signal Interference".)

9.04 A Frequency modulated carrier appears as a carrier which is "wobbling" sideways.

9.05 A speech or music modulation FM signal appears as a multiplicity of deflections spreading over a variable bandwidth.

9.06 A CW signal appears and disappears in step with the keying of the transmitter. During the moments when the signal is off the frequency sweep axis closes at the base on the signal. A radio operator used to reading CW signals on phones can, with a little practice, read such signals directly off the screen. In very rapdily keyed signals the deflection and the base line are seen simultaneously.

A MCW signal appears like a CW signal of periodically varying height. If the modulation rate is high, sidebands will appear as explained above.

9.07 Signal Interference. Two signals which are so close in frequency as to cause aural interference (beats); may appear on the screen as a signal deflection, varying in height as with a modulated signal. As the frequency separation is increased, the deflection appears as if modulated on one side only. Further increase of frequency will cause a "break" in the apex of the deflection. By reducing the sweepwidth of the adaptor, the respective deflection will gradually separate.

9.08 Transient Disturbances, generally received as noises in the receiver, are of two types; periodic and aperiodic transients.

Periodic transients, such as produced by automobile ignition, motors, vibrators, buzzers, etc., appear as signals moving along the frequency sweep base line in one direction or another. Thus, an automobile, which is accelerating will produce a set of deflections which may move first in one direction, slow down stop, and then move in an opposite direction. This is caused by the fact that the adaptor is sweeping at a fixed rate (30 times per second), whereas the transient occurs at a variable rate. The images stand still on the screen when there is synchronism between the two. If the transient disturbances are synchronized with the 60 cycle line the "noise" appears as a fixed signal which, however, does not move on the screen when the receiver is tuned, but only varies in height. Such deflections may appear like amplitude modulated signals or like steady carriers. (See below: "Diathermy apparatus"). Aperiodic transients, such as "static" appear as irregular deflections and flashes along the whole frequency sweep axis.

9.09 Tube noises, due to too great an amplification of the receiver, or adaptor, or both, appear as varying irregularities along the frequency sweep axis. Proper adjustment of the gain controls should reduce or eliminate this disturbance.

9.10 Images. If the receiver allows "images" to pass (due to poor image rejection of the R.F. circuits) these will be distinguishable from normal signals by the fact that they move in an opposite direction with respect to normal signals on the screen of the panoramic adaptor when the companion receiver is being tuned. Such images are most likely to appear on the higher frequency ranges of the receiver.

9.11 Harmonics, produced in the receiver by the best of very strong signals with harmonics of the oscillator, will be distinguishable from other signals by the fact that they move on the screen more rapidly (with turning) than the normal signals. (Twice as fast for second harmonic spurious signals.) Generally, a reduction in the gain of the receiver will eliminate this type of spurious signals.

9.12 Diathermy apparatus using an unfiltered or A.C. power supply will produce a periodic disturbance which will cause a deflection to appear on certain portions of the screen and disappear on other portions. This is due to the fact that such equipment emits a signal pulsating in synchronism with the power line. On the other hand, the adaptor too, is sweeping the spectrum in synchronism with the line, but a lower frequency (30 cycles) and only when a certain phase relationship exists is it possible for the adaptor to receive those periodic pulses.

9.13 Spurious Signals. If the signal strength exceeds a certain value, the deflection caused by any signal breaks up into a series of parallel deflectionism somewhat similar to side-bands. These spurious signals can take place either in the receiver or adaptor on extremely strong signals. A slight reduction in the gain of the adaptor will eliminate this type of distortion.

9.14 Use of the A.V.C. of the receiver. When the receiver is using A.V.C., the signal appearing on the center of the screen will control the height of all other signals. If the receiver is tuned to a strong signal, the weaker adjacent signals will be reduced in height or may not appear at all. It may be found expedient, in most applications, to operate the receiver with the A.V.C. cut off.

10. Circuit Components

10.01 Input Bandpass Transformer

T101 is the input bandpass transformer. It contains windings (T and B) which are permeability-tuned by means of iron cores. It is connected to the grid of V101, a 6AC7, which is the bandpass amplifier tube. This transformer is tuned to pass a band centered at the receiver's I.F. and extending somewhat less than half the sweepwidth on each side.

10.02 R.F. Gain Control

Potentiometer R101 which is connected in the cathode of the V101 tube, is the R.F. gain control of the PANADAPTOR. It is mounted on the front panel and is marked GAIN.

10.03 Output Bandpass Transformer

T102 is the output bandpass transformer containing windings (T and B) permeability-tuned by means of iron cores, and is connected to the grid of V102. It is tuned in the same manner as T101 and to the same frequency.

10.04 Mixer Tube

Tube V102, 6SA7, functions at the frequency converter.

10.05 Composite Coil

Transformer Z101 is a composite coil. It consists of the coil used in the tuned circuit of the oscillator. This composite coil is connected between the reactor tube, V107 (see below) and the oscillator tube (part of V102).

The proper mean frequency, F_o, of the oscillator is the sum of the intermediate frequencies of the receiver and of the adaptor. (It is the difference in the 10.2 MC and 10.7 MC input T1000), (see Theory of Operation. Par, 4.06). Tuning is usually obtained by adjustment of the panel control marked "CENTER FREQ." as described in Par. 8.05 above. However, in extreme circumstances, it may be necessary to re-align the adaptor by tuning the F. M. oscillator coil from the top of the chassis. This will be detailed below, Par. 11.03-5a.

10.06 Reactor Tube

The reactor tube, V107, is a 6AC7. A potentiometer, R139, marked C.F. PAD, connected in the cathode, serves to adjust the panadaptor for a linear frequency sweep at the correct center frequency. This pad is mounted on the chassis near the cathode ray tube. It has been set at the factory. Unless the Panadaptor has been serviced this pad will need no adjustment.

If V107 has to be replaced by another 6AC7 tube, there may result a change in frequency because of the variations in characteristics of the two tubes. This may be offset by resetting either the C.F. PAD or the zero adjustment in Z101.

NOTE: DO NOT ADJUST THIS CONTROL BEFORE YOU BECOME THOROUGHLY FAMILIAR WITH SERVICING PROCEDURE.

10.07 Sweep Voltage Generator

The sweep, or sawtooth voltage generator, is an oscillator, of the B.T.O. (blocking tube oscillator) type. It is composed of B.T.O. transformer T103, one-half of tube V111, and associated components.

Tube V111 is a 6SL7-GT double triode. One-half of the tube is used to generate the sawtooth voltage, which is then applied to a push-pull amplifier consisting of the other half of V111 and of one-half of V108 which is another 6SL7-GT tube.

This circuit is capable of generating a sawtooth voltage of any frequency between 20 and 40 cycles. A certain amount of alternating current is fed into the grid of the V111 tube from the filament winding of the main power transformer T104, in order to "lock" the sweep frequency to a submultiple of the line frequency. This is if the A.C. line frequency is 60 cycles per second, the sweep frequency is locked at 30 cycles; if the A.C. line frequency is 50 cycles per second, the sweep frequency is locked at 25 cycles.

10.08 Sweep Frequency

The potentiometer R132 is the semi-adjustable control (front panel) marked in red, SYNCH. This resistor regulates the blocking of the sawtooth generator, and therefore, the frequency of the sawtooth voltage.

10.09 Sawtooth Voltage Amplitude

The output from the sawtooth generator half of tube V111 is fed through a coupling capacitor C125, to potentiometer R135.

The latter is a semi-adjustable control marked in red "BASELINE SIZE". This potentiometer controls the amount of sawtooth voltage applied to the grid of the horizontal amplifier section V111. The greater the amplitude of the sawtooth voltage, the longer the horizontal base line. The output from this section of V111 drives one horizontal deflection plate of cathode ray tube, V109, and also passes through fixed resistor, R151, to drive the grid of one section of tube V108. The output from this half of the push-pull horizontal amplifier drives the remaining horizontal deflection plate in V109 in phase opposition to the voltage driving the other horizontal deflection plate.

10.10 Sweepwidth Control

The sweepwidth control, R137 (SWEEP WIDTH FACTOR), regulates the amplitude of the sawtooth voltage applied to the grid of the reactor tube. When the sweep voltage is reduced to zero, the reactor tube will no longer affect the oscillator, and therefore this oscillator will operate only at its mean frequency, F_o.

The sawtooth voltage, developed across the cathode follower of the sawtooth voltage amplifier is fed through a coupling capacitor C126 to the two potentiometer R136 and R137 in series.

10.11 Sweepwidth Limiter

R136 is a semi-adjustable pad (front panel,)"SWEEP WIDTH LIMIT" so adjusted that, with R137 (SWEEP WIDTH FACTOR) at its maximum value (full clockwise position) the sweepwidth is equal to the specified maximum.

The panel in front of the control knob for R137 is engraved 0.2., .5.8, 1.0. The calibration at 1.0 is accurate. The other calibrations are approximate.

10.12 I.F. Amplifier Stage

This stage consists of an input F.F. transformer, Z102, a 6SG7 tube V103 and an output I.F. transformer Z103. These transformers are tuned to the frequency shown in the chart of electrical characteristics and are set for critical coupling.

10.13 I.F. Pad

The gain and band width of the I.F. section is controlled by the potentiometer R115, the I.F. PAD.

10.14 Detector and Video Amplifier

Tube V104 (6SQ7) is a diode and triode in one envelope. The diode is used as the detector, and the triode is used as one of the video amplifiers. Direct coupling is used between the detector, the video amplifiers, and the vertical deflecting plates of the cathode-ray tube, V109 (3BP1).

10.15 Vertical and Horizontal Variable Positioning Controls

The vertical position of the baseline is controlled by R143, marked VERTICAL POSITION. The horizontal position of the base is governed by R147 marked HORIZONTAL POSITION. Both controls are semi-adjustable and both are recessed behind the front panel.

10.16 Cathode-Ray tube

The cathode-ray tube V109 (3P1) consists of a number of elements operating a high potential. When the potentials are applied in a proper ratio they cause the electrons emitted from the cathode to be accelerated to a high velocity and focussed into a sharp beam. This high velocity electron beam continues toward the face of the tube striking a phosphorescent coating, and causing a green glow to appear as a dot on the screen of the cathode-ray tube. There are two sets of parallel plates in the cathode-ray tube, one set causes the beam (green dot) to be deflected in a horizontal direction, the other set cause the beam (green dot) to be deflected in a vertical direction.

As a result of these deflections, which are very rapid, the moving beam will trace a continuous pattern on the screen of the cathode-ray tube.

10.17 Brillance Control

Resistor R162 is used to control the brightness of the trace on the screen. This control is a semi-adjustable one, and marked in white, BRILLIANCE.

10.18 Focus Control

Potentiometer R160 is used to control the sharpness of the trace on the screen. This control is seimi-adjustable and marked in white, FOCUS.

10.19 Power Supply

The power supply of the PANADAPTOR consists of a main power transformer T104, and two rectifying tubes V105 (2x2) and V110 (6X5GT). The power transformer is normally wired for 115 volts.

The high voltage rectifier (V105) provides the necessary voltages to the cathode-ray tube. The output of the low voltage rectifier (V110) is filtered by chokes L101A and L101B (in a common case) and capacitors C112, C113 and C114. The filtered output from the low voltage rectifier feeds a voltage regulating tube V106 (VR105). This regulated 105 volt output supplies the plate voltage for V101, and the screen voltage for V107 and the plate voltage for the oscillator section of V102.

11. Servicing Procedure

CAUTION: - OPERATION OF THE EQUIPMENT INVOLVES THE USE OF HIGH VOLTAGES WHICH ARE DANGEROUS TO LIFE. OPERATING PERSONNEL MUST AT ALL TIMES OBSERVE ALL SAFETY REGULATIONS. DO NOT CHANGE TUBES OR MAKE ADJUSTMENTS INSIDE EQUIPMENT WITH HIGH VOLTAGES ON. UNDER CERTAIN CONDITIONS DANGEROUS POTENTIALS MAY EXIST IN CIRCUITS WITH POWER CONTROLS IN THE OFF POSITION DUE TO CHARGES RETAINED BY CAPACITORS. ETC. TO AVOID CASUALTIES ALWAYS REMOVE POWER DISCHARGE AND GROUND CIRCUITS PRIOR TO TOUCHING THEM.

11.01 Equipment required for Servicing

In order to service the PANADAPTOR the following equipment should be available:

(a) Volt-ohmeter (at least 1000 ohms per volt) or VTVM

(b) Signal generator to cover a range of the IF and RF of the PANADAPTOR. See chart of Electrical Characteristics.

(c) A cathode ray oscillograph is optional, but will be needed if it is desired to examine the sawtooth voltage form.

11.02 Miscellaneous Data

11.02-1 Removal of Chassis from the Cabinet:

(a) Disconnect the power cable from the A.C. line. Then, at chassis end of cable, rotate plug to

11.02 Miscellaneous Data cont.

(a) cont.
left and disengage.

(b) Disconnect the input cable, by unscrewing the connector at chassis end of cable.

(c) Unfasten the seven panel thumbscrews and the screw in center rear of cabinet.

(d) Grasp two of the thumbscrews on the panel and pull forward.

11.02-2 Removal of Cathode-Ray Tube

(a) Loosen the clamp which supports the tube and shield.

(b) Lift the spring fingers of the shield which are on the lip of the socket.

(c) Grasping the tube and shield in one hand, remove the socket with the other hand. (A prying tool may have to be used here.)

(d) Grasp the tube and shield with one hand, and ease it out through the metal hood or shield which forms part of the front panel. Note that the cathode-ray tube is protected by a sponge rubber boot, which will come out with the tube when it is removed. The boot also serves to hold in place the calibrated green filter screen.

(e) Remove boot simply by pulling it off the cathode-ray tube. The tube will then come out of the shield.

11.02-3 Power Transformer Connections (See Circuit Diagram)

11.02-4 Tuning the R.F. and F.M. Oscillator Coils

Transformer T101, T102, Z101, Z102, Z103, are tuned by means of movable iron cores. Windings "T" can be tuned at the top of the coils by means of the tuning tool which is provided with the PANADAPTOR. Use the end which has a pin passed through the bakelite rod. Windings "B" can be tuned either from the top of the transformer or from the bottom. When tuning from the bottom use a screwdriver. When the tuning is done from the top, use the other end of the tuning tool, which is ended as a screwdriver, and insert it through the opening of the core. The iron slugs of windings "B" have a slot provided for this purpose.

11.03 Alignment Procedure

(First: - Allow equipment to warm up for at least 1/2 hour.) NOTE: - When the PANADAPTOR is used in conjunction with a companion receiver, the (+) sign on the calibration screen indicates high frequency, and the (-) sign on the calibration screen indicates low frequency, but when the signals are fed directly into the adaptor (as from a signal generator), the (-) sign indicates high frequencies, while the (+) sign indicates lower frequencies.

11.03-1 Synchronization of Sweep Frequency

The frequency of the sawtooth voltage is adjusted by a semi-adjustable control, R132 (SYNCH) to a sub-multiple of the A.C. line frequency. The standard frequency for the adaptor is 30 cycles when used with a 60 cycle line, and 25 cycles when used with a 50 cycle line.

In order to check this adjustment, A.C. line frequency can be obtained from Pin #7 of tube V104 and fed through a .01 mfd coupling capacitor to Pin #6 of the tube V104. Two peaks will appear on the screen if the sweep frequency is one-half of the line frequency.

11.03-2 Adjustment of Baseline Trace

Adjust semi-adjustable controls R-135 (BASELINE SIZE) and R-147 (HORIZONTAL POSITION) for a centered baseline trace that extends approximately 1/4 to 1/2 division beyond the extremes of frequency calibration. Adjust R-143 (VERTICAL POSITION) for coincidence of baseline trace with the baseline of the screen.

11.03-3 Adjust R-160 (FOCUS) and R-162 (BRILLIANCE) as is required for a suitable trace.

11.03-4 I.F. Amplifier Alignment

The I.F. amplifier frequency for the Panadaptor is ad follows:

Type	IF
T50	110 KC
T200	226 KC
T1000 (5.25 MC input)	912 KC
T1000 (10.2 MC, 10.7 MC input)	1.5 MC

11.03-4 cont.

(a) Turn R-115, the I.F. PAD located on the chassis, to the center of its rotational range. If oscillation occurs during the following procedure (indicated by a baseline rise) turn the I.F. PAD counterclockwise.

(b) Using the signal generator, feed the I.F. specified above through a .01 mfd capacitor into the grid (pin 4) of the tube V103. Adjust the cores of the second I.F. transformer, Z103 for the highest vertical deflection obtainable on the screen of the cathode-ray tube.

(c) Feed the same I.F. through a .01 mfd capacitor into the grid (pin 8) of tube V102. Adjust the cores of the first I.F. transformer Z102 for the highest vertical deflection obtainable on the screen of the cathode-ray tube.

(d) Through a .01 mfd capacitor feed into the grid (pin 8) of tube V102 the center frequency of equipment. See selection 11.03-5 (a) 1 below for the proper frequency. If a pip does not appear at the center of the screen, adjust the frequency and level of the signal generator so that it does appear at the center of the screen. Adjust the SWEEPWIDTH FACTOR until the base of the pip covers approximately one-half of the screen. Trim the cores of Z102 and Z103 for a symmetrical pip shape.

11.03-5 Frequency Modulated Oscillator Alignment

The following adjustments are a series of approximations, which are narrowed down until the desired results are obtained. During the entire procedure the signals are fed into the input of the PANADAPTOR through the cable and the proper isolating element at the end of the cable.

(a) Center Frequency Alignment

Generally, an adjustment of the bottom core of Z101 is sufficient. If, however, all controls are out of adjustment proceed as follows:

NOTE: There are two conditions of maximum in adjusting the bottom core. Choose the one that results in the maximum number of screw thread showing.

1. Feed in a signal equal to the input center frequency of the Panadaptor.

Type	Input Center Frequency
T50	455 KC
T200	455 KC
T1000	5.25 MC
T1000	10.2 MC
T1000	10.7 MC

2. Set the SWEEPWIDTH FACTOR control at maximum.

3. Set the CENTER FREQ. control at the panel marker.

4. Adjust the bottom core of transformer Z101 so that the deflection on the cathode-ray tube screen is approximately centered. In order to achieve centering it also may be necessary to adjust C.F. PAD control R139 until the deflection appears on the screen at center. (Some adjustment of SWEEPWIDTH LIMIT, R136, may be necessary.)

5. Now gradually rotate the SWEEPWIDTH FACTOR control (R137) counterclockwise toward its minimum position. At the same time continue readjusting Z101 for a centered deflection.

6. The PANADAPTOR is properly adjusted for center frequency when, with the SWEEPWIDTH FACTOR control (R137) set just above its minimum position, a symmetrically centered pip appears on the screen.

7. Rotate SWEEPWIDTH FACTOR control (R137) to maximum. If the deflection fails to remain centered the HORIZONTAL POSITION control (R147) should be used.

8. In order to achieve a symmetrical pip it may be necessary to readjust the I.F. alignment slightly. See 11.03-4 (d).

(b) <u>High Frequency Alignment</u>

1. Feed in a signal equal to that shown under High Frequency Alignment in the chart below:

Type	High Frequency Alignment	Low Frequency Alignment
T-50	480 KC	430 KC
T-200	555 KC	355 KC

Type	High Frequency Alignment	Low Frequency Alignment
T-1000 (5.25 MC Center)	5.75 MC	4.75 MC
T-1000 (10.2 MC Center)	10.7 MC	9.7 MC
T-1000 (10.7 MC Center)	11.2 MC	10.2 MC

2. Set SWEEPWIDTH FACTOR control (R137) at maximum.

3. Adjust C.F. PAD (R139) until the deflection appears on the screen at the extreme left Calibration. Some adjustment of SWEEPWIDTH LIMIT (R136) may be necessary.

(c) NOW repeat Operation a. above (Center Frequency Alignment).

(d) LOW FREQUENCY ALIGNMENT

1. Feed in a signal equal to that shown under Low Frequency Alignment in the chart above.

2. Set the SWEEPWIDTH FACTOR control (R137) at maximum.

3. Adjust the SWEEPWIDTH LIMIT (R136) until the deflection appears on the screen at the extreme right calibration.

(e) AGAIN repeat Operation a. above (Center Frquency Alignment).

(f) Now repeat Operation b, above (High Frequency Alignment).

(g) Now repeat Operation a, b and d, above.

(h) FINALLY repeat center Frequency Alignment Operation.

(i) Repeat Operations g and h, above, until the desired degree of linearity is obtained.

11.03-6 R.F. Alignment

For this alignment a "cut and dry" method is required. It is possible to align the R.F. stages using only a signal generator. To determine the response characteristic of the R.F. stages, the frequency of the signal generator is varied while the amplitude is kept constant. The deflection peak on the screen moves from one side of the screen to the other, thereby defining the response characteristic.

Type	Input Center Frequency	High Peaking Frequency	Low Peaking Frequency
T-50	455 KC	478 KC	432 KC
T-200	455 KC	545 KC	365 KC
T-1000	5.25 MC	5.67 MC	4.83 MC
T-1000	10.2 MC	10.65 MC	9.75 MC
T-1000	10.7 MC	11.15 MC	10.24 MC

Set the SWEEPWIDTH FACTOR control at maximum and CENTER FREQ. Control on the panel marker.

NOTE: See schematic for location of primary and secondary cores.

A. Type T-50 and Type T-200

NOTE: The R.F. transformers used in this equipment have sliders. This makes it possible to adjust the spacing between the primary and secondary so as to obtain the proper frequency separation between the peak frequencies. If the frequency separation is correct, then it is only necessary to trim the cores of two R.F. transformers until the desired peak deflection is obtained. If the frequency separation is not correct, the full alignment procedure must be used. *

a. First align the interstage transformer T102

(1) Make the spacing between the primary and secondary windings approximately 1/16" for the T-200 and 1/2" for the T-50.

(2) Using a .01 mfd coupling capacitor, feed a signal equal to the input center frequency to the plate of V101 (pin #8). Tune the secondary for a peak deflection at the center of the screen.

(3) Apply a signal equal to the high peak frequency to the grid of V101 (pin #4). Tune the primary for a peak deflection.

(4) Applying the signal to grid of V101 (pin #4), vary the signal generator frequency over the R.F. band of the equipment noting the frequency separation between the high and low frequency peaks as read on the screen of the equipment.

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* The sliders have been waxed down to prevent movement. If it is necessary to change the position of the sliders, the waxing must be removed. Upon completion of the alignment procedure, rewax the coils to prevent movement.

If the frequency separation is greater than specified, increase the coil spacing.

If the frequency separation is less than specified, decrease the coil spacing.

(5) repeat steps (2), (3) and (4) until peak deflections and the proper frequency separation is obtained.

b. Then Align the Input Transformer T101.

(1) In order to see the response characteristic of T101, it is first necessary to load down the primary and secondary of T102. For this purpose our resistors of approximately 10K ohms clipped across both the primary and secondary of T102.

(2) Make the spacing between the primary and secondary windings approximately 1/;6" for the T-200 and 1/2" for the T-50.

(3) Connect the signal generator to lug 5 of T101 for T-50 and lug of T101 for T-200, and set the generator to the input center frequency. Tune the secondary for peak deflection at the center of the screen.

(4) Now apply to the input connector, through the input cable and specified isolating element, a signal equal to the high peak frequency. Adjust the primary for maximum deflection.

(5) Applying the signal to the input connector, using the input cable and isolating element, vary the signal generator frequency over the R.F. band of the equipment noting the frequency separation between the high and low frequency peaks as read on the screen of the equipment.

If the frequency separation is greater than specified, increase the coil spacing.

If the frequency separation is less than specified, decrease the coil spacing.

(6) repeat steps (3), (4) and (5) until peak deflections and the proper frequency separations are obtained.

(7) Remove the loading resistors across T102 used in steps (1) to (6).

(8) Examine the overall response characteristic and trim the primary and secondary of both R.F. transformers until the two peak deflections are of nearly equal amplitude and properly placed. A position between the edge of the screen and one-half of a division from the edge of the screen is considered proper.

See page 8.

NOTE: Other things equal, the peak to valley ratio is a function of how closely in frequency are the corresponding peaks of T101 and T102. Therefore, some degree of change can be made by changing the frequency separation of the peaks of one of the coils.

B. Type T-1000 (5.25 MC Input)

a. First, align the interstage transformer T102

(1) Through an .01 mfd coupling capcaitor feed a signal equal to the input center frequency to the plate pin#8 of V101.

Tune the secondary for a peak deflection at the center of the screen.

(2) Now apply a signal equal to the high peaking frequency to the grid pin #4 of V101. Tune the primary for a peak deflection.

b. Second, align the input transformer T101.

(1) Connect the generator to lug 1 of T101 and set the generator to the input center frequency. Tune the secondary for a peak deflection at the center of the screen.

(2) Now feed the high peaking frequency through the input cable and specified isolating element. Adjust the primary for maximum deflection.

(3) Examine the overall response characteristic and trim the primary and secondary of both R.F. transformers until the two peak deflections are of nearly equal amplitude and properly placed. A position between the edge of the screen and one-half of a division from the edge of the screen is considered proper. See page 8.

C. Type T-1000 (10.2 MC and 10.7 MC Input)

a. Align first the interstage transformer T102

(1) Feed a signal equal to the input center frequency of the PANADAPTOR to the plate (pin #8) of R.F. amplifier tube V101 (6AC7) through .01 mfd coupling capacitor and adjust secondary for a maximum deflection at the center of the screen.

(2) Now feed in a signal equal to the high peaking frequency into the grid (pin #4) of the R.F. amplifier tube V101 (6AC7) and tune primary for a maximum deflection.

(3) Now feed in a signal equal to the low peaking frequency to the grid (pin 4) of V101 and tune the coupling coil (mounted on the bottom place of T102 in place of lug #5) for a maximum deflection.

(4) Repeat (1), (2) and (3) until peak deflections and the proper frequency spearations are obtained.

(5) Second, Align the Input Transformer T101

(1) Feed in a signal equal to the input center frequency of the PANADAPTOR to lug 1 of T101 and adjust the secondary for a maximum deflection at the center of the screen.

(2) Now feed the high peaking frequency to the input connector through the input cable and specified isolating elements. Tune the primary for a maximum deflection.

(3) Feed in the low peaking frequency to the input connector through the input cable and specified isolating elements. Tune the coupling coil (mounted on the bottom plate of T101 in place of lug #5) for a maximum deflection.

(4) Repeat steps (1), (2) and (3).

(5) Examine the overall response characteristic and trim the primary and secondary of both R.F. transformers until the two peak deflections are of nearly equal amplitude and properly placed. A position between the edge of the screen and one-half of a division from the edge of the screen is considered proper. See page 8.

(6) Increase the signal generator level 10 times. Turn the GAIN control counterclockwise to bring the pip height back to that obtained at the original setting of the signal generator. Then repeat step (5).

(7) Reduce the signal generator level 10 times and turn the GAIN control clockwise to bring the pip height back to that obtained at the original setting of the signal generator. Then repeat step (5).

(8) Repeat steps (6) and (7) until proper response is obtained at the two different settings of the GAIN control.

NOTE: Other things being equal, the peak to valley ratio is a function of how closely in frequency are the corresponding peaks of T101 and T102. Therefore some degree of change can be made by changing the frequency separation of the peaks of one of the coils.

11.03-7 Standard Sensitivity

With GAIN control fully clockwise feed in a signal of a voltage equal to the standard sensitivity voltage, at a frequency equal to the input center frequency of the Panadaptor to the input connector, through the input cable and specified isolating elements. Adjust the I.F. PAD for 1/4 inch pip deflection. This may affect standard sensitivity. Repeat until both standard sensitivity and proper I.F. alignment is achieved. Do not turn the I.F. PAD so far as to cause oscillation.

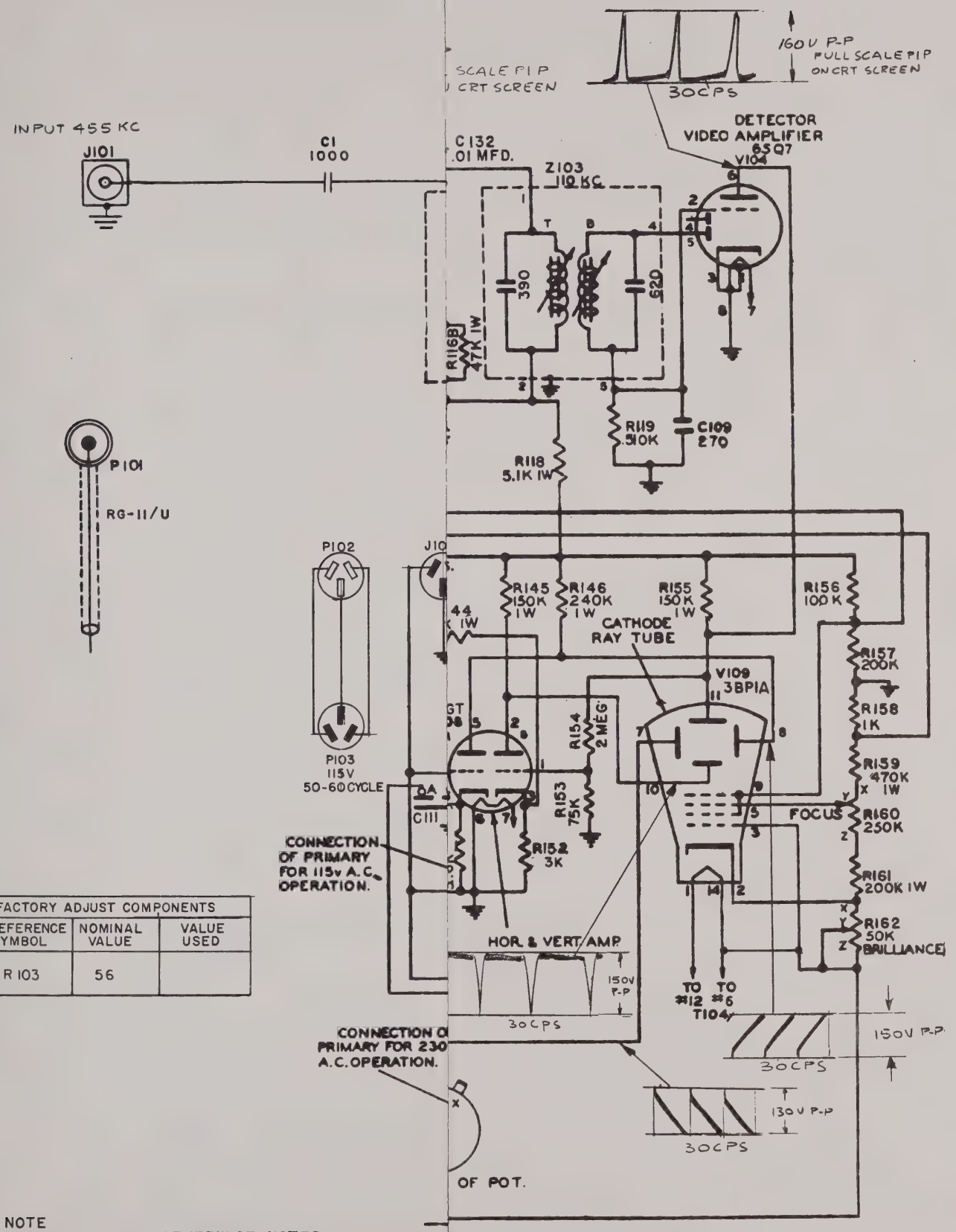
11.03-8 Resolution

Resolution is defined as the frequency separation of two signals of equal level required to produce corresponding pips which intersect 30% down from their peak amplitude, at maximum scanning width. If the resolution is not as specified, the following method should be used. If improvement of resolution is required, pins 4 and 8 of V103 should be bent toward center of socket. Pushing these pins away from each other has the opposite effect on resolution. If when the pips are bent together, I.F. oscillation occurs, as evidenced by a rise in the base line trace, pins 4 and 8 are too close to the center of the socket and should be spread somewhat further away. If provement of resolution is required and the above technique is unsuccessful then a change in the alignment I.F. section can be tried. In section 11.03-4 (b) the adjustment of the bottom core of Z103 that resulted in the maximum number of threads showing was selected. To improve resolution choose the other condition of maximum, i.e., the one with the least number of threads showing.

NOTE:

Measurement of resolution involves the use of two signal generators producing high frequencies. Ordinarily, at such frequencies it is not feasible to read such a small difference as the resolution directly from a signal generator dial. Therefore an indirect method of determining frequency separation is utilized. One of the two signals is amplitude modulated to produce a sideband frequency which is equal to the frequency of the other signal. Since the frequency difference between the

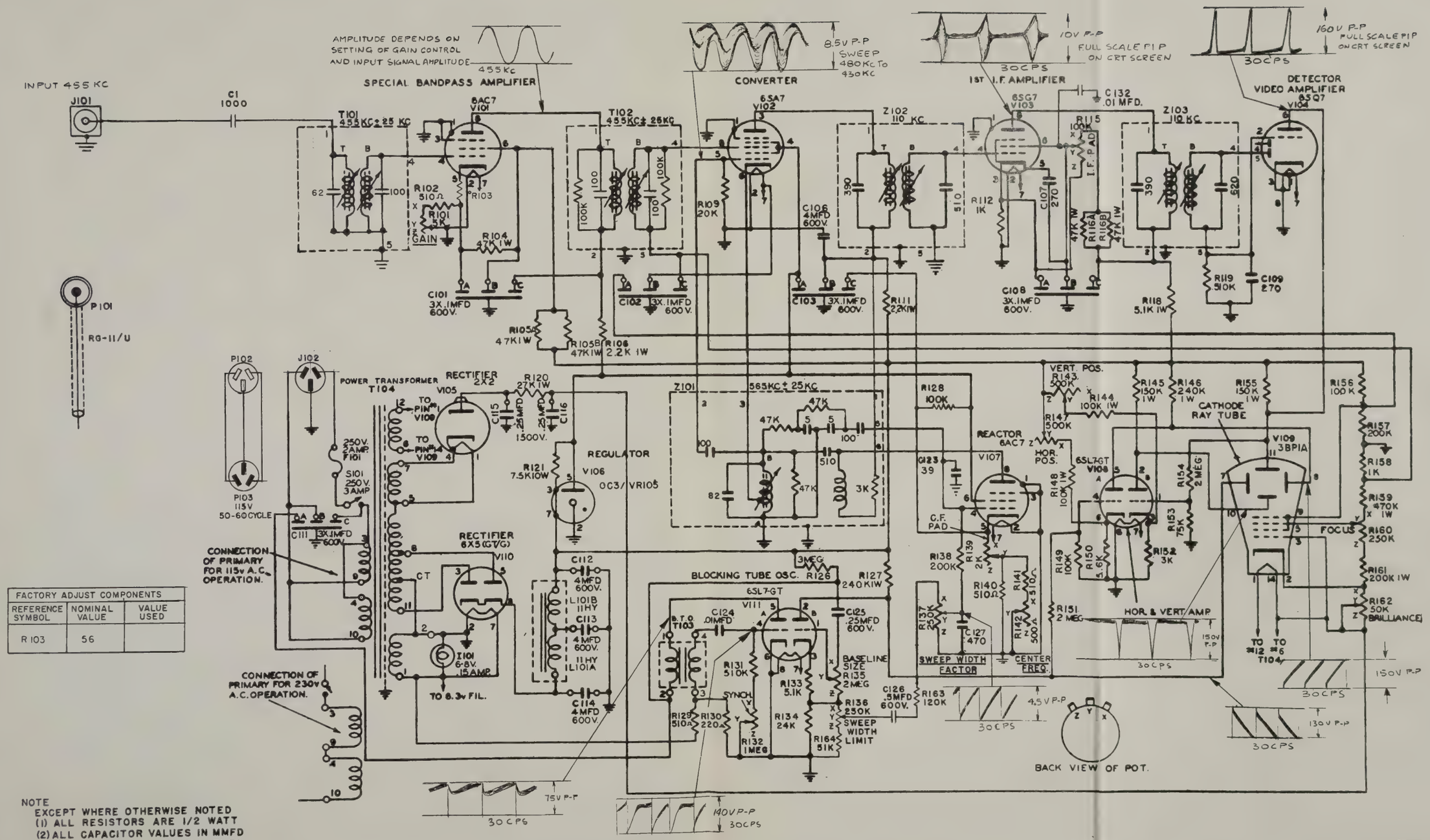
sideband and the carrier is equal to the modulating frequency, the modulating frequency in effect represents the difference between the two signal frequencies. For example, if two signals are separated by 11 KC, amplitude modulation of one signal with 11 KC will cause one of the sidebands to be superimposed on the other signal. Superimposition is recognized on the panormaic indicator by the merging of the sideband pip and the unmodulated signal pip into a common pip which pulsates in height. The closer the two are in frequency, the slower the "bobble" or pulse rate. When the sideband and unmodulated signal are identical in frequency, the common pip will rise to some fixed maximum height or fall to a constant mimimum height. This is the condition of zero beat. At maximum scanning width the pips are then extremely sharp and it may be difficult to observe zero beat. It will, therefore, be found more convenient to increase the pip width by reducing the scanning width. This will result in an improved resolution. Figures for the resolution at 20% of maximum sweepwidth are given in the chart of electrical characteristics. Note that there is a tendency for the modulated signal to shift in frequency as the modulation percentage is changed, the accuracy of the resolution measurement will be affected accordingly.



FACTORY ADJUST COMPONENTS		
REFERENCE SYMBOL	NOMINAL VALUE	VALUE USED
R 103	56	

NOTE
EXCEPT WHERE OTHERWISE NOTED
(1) ALL RESISTORS ARE 1/2 WATT
(2) ALL CAPACITOR VALUES IN MMFD
(3) * FACTORY ADJUST COMPONENTS

556155-049 08



FACTORY ADJUST COMPONENTS		
REFERENCE SYMBOL	NOMINAL VALUE	VALUE USED
R 103	56	

NOTE
EXCEPT WHERE OTHERWISE NOTED
(1) ALL RESISTORS ARE 1/2 WATT
(2) ALL CAPACITOR VALUES IN MMFD
(3) * FACTORY ADJUST COMPONENTS

556155-049 08

Model SA-3, T-50-Schematic Diagram

REPLACEMENT PARTS LIST

Ref. Symbol	Description	Singer Part No.
C1	CAPACITOR: fixed, silvered mica, 1000 uuf, ± 5%	556086-004
C101	CAPACITOR: fixed, paper, oil filled, bathtub, bottom mount, 3 X .1 uf, 600 V	556112-009
C102	CAPACITOR: fixed, paper, oil filled, bathtub, bottom mount, 3 X .1 uf, 600 V	556112-009
C103	CAPACITOR: fixed, paper, oil filled, bathtub, bottom mount, 3 X .1 uf, 600 V	556112-009
C106	CAPACITOR: fixed, paper, oil filled, tubular, stud mount, 4 uf, 600 V	556076-030
C107	CAPACITOR: fixed, silvered mica, 270 uuf, ± 5%	556082-012
C108	CAPACITOR: fixed, paper, oil filled, bathtub, bottom mount, 3 X .1 uf, 600 V	556112-009
C109	CAPACITOR: fixed, silvered mica, 270 uuf, ± 5%	556082-012
C111	CAPACITOR: fixed, paper, oil filled, bathtub, bottom mount, 3 X .1 uf, 600 V	556112-009
C112	CAPACITOR: fixed, paper, oil filled, tubular, stud mount, 4 uf, 600 V	556076-030
C113	CAPACITOR: fixed, paper, oil filled, tubular, stud mount, 4 uf, 600 V	556076-030
C114	CAPACITOR: fixed, paper, oil filled, tubular, stud mount, 4 uf, 600 V	556076-030
C115	CAPACITOR: fixed, paper, oil filled, tubular, stud mount, .25 uf, 1500 V	556105-004
C116	CAPACITOR: fixed, paper, oil filled, tubular, stud mount, .25 uf, 1500 V	556105-004

Ref. Symbol	Description	Singer Part No.
C123	CAPACITOR: fixed, silvered mica, 39 uuf, ± 5%	556081-026
C124	CAPACITOR: mica, .01 uf, ± 10%	556093-001
C125	CAPACITOR: fixed, paper, oil filled, bathtub, bottom mount, .25 uf, 600 V	556109-010
C126	CAPACITOR: fixed, paper, oil filled, bathtub, top mount, .5 uf, 600 V	556109-003
C127	CAPACITOR: fixed, silvered mica, 470 uuf, ± 5%	556082-013
C132	CAPACITOR: fixed, ceramic disc, .01 uf, 500 V	556060-015
F101	FUSE: cartridge, 1 1/4" lg., 1/4" dia., 2 amp., 250 V	556006-001
I101	LAMP: pilot, #47	556002-006
J101	RECEPTACLE: 1-contact, female, rf, type uhf	556010-004
J102	RECEPTACLE: 3-pin (2 curved), male, twist-lock	556010-003
L101	CHOKE: filter, dual, 11 henries each section	556012-116
P101	PLUG: 3-piece, 1-pin, male, type UHF	556016-002
P102-P103	CORDSET: A.C. power line cord, 3-wire, with 2 plugs	556161-066
R101	RESISTOR: variable composition, CCW taper, 5K ohms, ± 10%, 2 W	556052-010
R102	RESISTOR: fixed, composition, 510 ohms, ± 5%, 1/2 W	151-1003-511J
R103	RESISTOR: fixed, composition, 56 ohms, ± 5%, 1/2 W (Nominal - Factory Selected)	151-1003-560J
R104	RESISTOR: fixed, composition, 47K ohms, ± 5%, 1 W	151-1004-473J
R105	RESISTOR: fixed, composition, 24K ohms, ± 5%, 2 W	151-1005-243J

Ref. Symbol	Description	Singer Part No.
R106	RESISTOR: fixed, composition, 2.2K ohms, ± 5%, 1 W	151-1004-222J
R109	RESISTOR: fixed, composition, 20K ohms, ± 5%, 1/2 W	151-1003-203J
R111	RESISTOR: fixed, composition, 2.2K ohms, ± 5%, 1 W	151-1004-222J
R112	RESISTOR: fixed, composition, 1K ohm, ± 5%, 1/2 W	151-1003-102J
R115	RESISTOR: linear, variable composition, 100K ohms, ± 10%, 2 W	556052-025
R116	RESISTOR: fixed, composition, 24K ohms, ± 5%, 2 W	151-1005-243J
R118	RESISTOR: fixed, composition, 5.1K ohms, ± 5%, 1 W	151-1004-512J
R119	RESISTOR: fixed, composition, 510K ohms, ± 5%, 1/2 W	151-1003-514J
R120	RESISTOR: fixed, composition, 27K ohms, ± 5%, 1 W	151-1004-273J
R121	RESISTOR: radial lead, fixed, wire wound, 7.5K ohms, 10 W	556045-025
R126	RESISTOR: fixed, composition, 3 Megohms, ± 5%, 1/2 W	151-1003-305J
R127	RESISTOR: fixed, composition, 240K ohms, ± 5%, 1 W	151-1004-244J
R128	RESISTOR: fixed, composition, 100K ohms, ± 5%, 1/2 W	151-1003-104J
R129	RESISTOR: fixed, composition, 510 ohms, ± 5%, 1/2 W	151-1003-511J
R131	RESISTOR: fixed, composition, 510K ohms, ± 5%, 1/2 W	151-1003-514J
R132	RESISTOR: linear, variable composition, 1 Megohm, ± 20%, 2 W SYNCH	556052-002
R133	RESISTOR: fixed, composition, 5.1K ohms, ± 5%, 1/2 W	151-1003-512J
R134	RESISTOR: fixed, composition, 24K ohms, ± 5%, 1/2 W	151-1003-243J

Ref. Symbol	Description	Singer Part No.
R135	RESISTOR: linear, variable composition, 2 Megohms, ± 20%, 2 W BASELINE SIZE	556052-017
R136	RESISTOR: linear, variable composition, 250K ohms, ± 10%, 2 W SWEEP WIDTH LIMIT	556052-024
R137	RESISTOR: linear, variable composition, 250K ohms, ± 10%, 2 W SWEEP WIDTH FACTOR	556052-024
R138	RESISTOR: fixed, composition, 220K ohms, ± 5%, 1/2 W	151-1003-224J
R139	RESISTOR: linear, variable composition, 2K ohms, ± 10%, 2 W CF PAD	556052-040
R140	RESISTOR: fixed, composition, 510 ohms, ± 5%, 1/2 W	151-1003-511J
R141	RESISTOR: fixed, composition, 510 ohms, ± 5%, 1/2 W	151-1003-511J
R142	RESISTOR: variable, composition, 500 ohms, ± 10%, linear, 2-watt CENTER FREQ.	556052-009
R143	RESISTOR: linear, variable composition, 500K ohms, ± 10%, 2 W VERTICAL POSITION	556052-015
R144	RESISTOR: fixed, composition, 100 K ohms, ± 5%, 1 W	151-1004-104J
R145	RESISTOR: fixed, composition, 150K ohms, ± 5%, 1 W	151-1004-154J
R146	RESISTOR: fixed, composition, 240K ohms, ± 5%, 1 W	151-1004-244J
R147	RESISTOR: linear, variable composition, 500K ohms, ± 10%, 2 W HORIZONTAL POSITION	556052-015
R148	RESISTOR: fixed, composition, 100K ohms, ± 5%, 1 W	151-1004-104J
R149	RESISTOR: fixed, composition, 100K ohms, ± 5%, 1/2 W	151-1003-104J
R150	RESISTOR: fixed, composition, 5.6K ohms, ± 5%, 1/2 W	151-1003-562J

Ref. Symbol	Description	Singer Part No.
R151	RESISTOR: fixed, composition, 2 Megohms, ± 5%, 1/2 W	151-1003-205J
R152	RESISTOR: fixed, composition, 3K ohms, ± 5%, 1/2 W	151-0003-302J
R153	RESISTOR: fixed, composition, 75K ohms, ± 5%, 1/2 W	151-1003-753J
R154	RESISTOR: fixed, composition, 2 Megohms, ± 5%, 1/2 W	151-1003-205J
R155	RESISTOR: fixed, composition, 150 K ohms, ± 5%, 1 W	151-1004-154J
R156	RESISTOR: fixed, composition, 100K ohms, ± 5%, 1/2 W	151-1003-104J
R157	RESISTOR: fixed, composition, 200K ohms, ± 5%, 1/2 W	151-1003-204J
R158	RESISTOR: fixed, composition, 1K ohm, ± 5%, 1/2 W	151-1003-102J
R159	RESISTOR: fixed, composition, 470K ohms, ± 5%, 1 W	151-1004-474J
R160	RESISTOR: linear, variable com- 250K ohms, ± 10%, 2 W FOCUS	556052-024
R161	RESISTOR: fixed, composition, 200K ohms, ± 5%, 1 W	151-1004-204J
R162	RESISTOR: linear, variable com- position, 50K ohms, ± 10%, 2 W	556052-014
R163	RESISTOR: fixed, composition, 120K ohms, ± 5%, 1/2 W	151-1003-124J
R164	RESISTOR: fixed, composition, 51K ohms, ± 5%, 1/2 W	151-1003-513J
S101	SWITCH: toggle, D.P.S.T., nickel or chromium	556019-043 556019-042
T101	TRANSFORMER: R F, 455 KC, ± 25 KC	556026-160
T102	TRANSFORMER: R F, 455 KC, ± 25 KC	556026-161
T103	TRANSFORMER: pulse	556020-096

Ref. Symbol	Description	Singer Part No.
T104	TRANSFORMER: power	556020-111
V101	TUBE: electron, 6AC7	556027-065
V102	TUBE: electron, 6SA7	556027-103
V103	TUBE: electron, 6SG7	556027-106
V104	TUBE: electron, 6SQ7	556027-113
V105	TUBE: electron, 2X2A	556027-032
V106	TUBE: electron, 0C3/VR105	556027-008
V107	TUBE: electron, 6AC7	556027-065
V108	TUBE: electron, 6SL7-GT	556027-111
V109	TUBE: cathode ray, 3BP1A	556027-034
V110	TUBE: electron, 6X5-GT	556027-120
V111	TUBE: electron, 6SL7-GT	556027-111
XBV106	CLAMP: tube base	556024-006
XF101	FUSE HOLDER: block type, single extractor type	556006-003 556006-013
XI101	HOLDER ASSY: pilot lamp, green lens, black nickel or chromium	 556002-260 556002-007
XV101	SOCKET: octal, ceramic	556024-060
XV102	SOCKET: octal, ceramic	556024-060
XV103	SOCKET: octal, ceramic	556024-060
XV104	SOCKET: octal, ceramic	556024-060
XV106	SOCKET: octal, ceramic	556024-060
XV107	SOCKET: octal, ceramic	556024-060
XV108	SOCKET: octal, ceramic	556024-060
XV109	SOCKET: diheptal C.R.T.	556024-191
XV110	SOCKET: octal, ceramic	556024-060
XV111	SOCKET: octal, ceramic	556024-060

Ref. Symbol	Description	Singer Part No.
Z101	COIL: oscillator, 565 KC ± 25 KC	556026-162
Z102	TRANSFORMER: R F, 110 KC	556026-163
Z103	TRANSFORMER: R F, 110 KC	556026-164
	ADAPTER: line cord, 3-wire to 2-wire	556023-105

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